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S/056/60/039/006/031/063
B006/B056

24.5100

AUTHOR: Stratonovich, R. L.

TITLE: Fluctuation Thermodynamics of Nonequilibrium Processes

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 39, No. 6(12), pp. 1647-1659

TEXT: Hitherto, the most important results obtained in the field of the quantum thermodynamics of nonequilibrium processes have been obtained by using perturbation-theoretical methods. In the present paper, a relation is derived between the two-dimensional characteristic function of the statistical equilibrium fluctuations and the one-dimensional characteristic function (distribution function) of the nonequilibrium process without using the perturbation theory. For the purpose of deriving this relation, the quantum-theoretical apparatus developed by Feynman (Ref. 5) is used. The relation obtained is (9): $\langle \exp \{ u \int_0^1 e^{-ih\beta s p_s} (F)_s ds \} \exp \{ u_\tau F_\tau \} \rangle = \exp \{ \beta \mathcal{F} - \beta \mathcal{F}_u \} \langle \exp \{ u_\tau F_\tau \} \rangle_{kTu}$. Equilibrium at the temperature $T = 1/k\beta$

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Fluctuation Thermodynamics of Non-equilibrium Processes

is determined by the density matrix $\varrho = e^{\beta\Psi - \beta H}$, where $\Psi \equiv \Psi(T,a)$ $= -\beta^{-1} \ln Sp\, e^{-\beta H}$ the free energy, a - thermodynamical parameter, the other parameters being defined as usual (cf. Ref. 5), and the Feynman relation $e^{-\beta H + uF} = \exp\left\{\int_{0}\left[-\beta(H)_s + u(F)_s\right]ds\right\}$ holds. This universal relation (9) between the equilibrium distribution of the fluctuations and the non-equilibrium fluctuation processes leads to a number of new results. In the transition to one-dimensional distribution, an important formula is obtained, which furnishes the quantum generalization of the theory of equilibrium functions by V. B. Magalinskiy and Ya. P. Terletskiy. From (9) it is possible, by differentiation, to derive Callen's equation in the theory of non-equilibrium fluctuations. By means of (9) it is further possible to investigate a phenomenon of basic interest, called "residual correlations", which consists in the fact that in the case of equilibrium fluctuations, the correlations between the values of thermodynamical parameters do not vanish if the interval of time is increased; thus, this is a case of non-ergodicity. The residual correlations and the non-

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Fluctuation Thermodynamics of Non-equilibrium Processes

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ergodicity coefficient introduced can be expressed by the thermodynamical functions of the system. In the case of a proportional increase of the volume of the system and of the number of particles it contains, residual correlations and non-ergodicity coefficient remain finite. If the principle of the reversibility of the time axis is applied to (9), the reciprocity conditions may be derived herefrom. As, in this case, the smallness of the perturbation is not assumed, the deviation of the non-equilibrium process from the equilibrium process need not necessarily be small, and the equation describing a relaxation process need not necessarily be linear (Onsager equation). It is shown how the Onsager relations can be extended to nonlinear nonequilibrium processes. V. V. Vladimirskiy is mentioned. There are 9 references: 4 Soviet and 5 US.

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ASSOCIATION: Moskovskiy gosudarstvennyy universitet (Moscow State University)

SUBMITTED: May 25, 1960

Card 3/3

STRATONOVICH, R.L.; KLIMONTOVICH, Yu.L., nauchnyy red.,dots.;IVANUSHKO,N.D., red.; SVESHNIKOV, A.A., tekhn. red.

[Selected problems concerning the theory of fluctuations in radio engineering] Izbrannye voprosy teorii fliuktuatsii v radiotekhnike. Moskva, Izd-vo "Sovetskoe radio," 1961. 557 p. (MIRA 14:12)
(Radio)

S/024/61/000/002/011/014
E140/E113

6.9200

AUTHOR: Stratonovich, R.L. (Moscow)

TITLE: Conditional distribution of correlated random points and utilization of the correlation for the optimal detection of a pulse signal in noise

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Energetika i avtomatika, 1961, No.2, pp.148-158

TEXT: The author considers the general problem of a variable number of pulses with correlation between given pulses in the train and shows that utilization of the a priori knowledge of the correlation permits improved detection of pulses in noise. Let A denote the event in which there are n random points in the signal, displaced a small amount from their true positions in the signal. Then the conditional density distribution for the signal with noise for the event A can be used, with suitable passage to the limit of zero displacement, to determine the conditional probability for the n points and this in turn leads to the a posteriori distribution function. A number of results given in an appendix are involved in the derivation. Two examples

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B102/B108

24.2200 (1144, 1147, 1164)

AUTHOR: Stratonovich, R. L.

TITLE: Statistics of magnetization in the Ising model

PERIODICAL: Fizika tverdogo tela, v. 3, no. 10, 1961, 2955 - 2966

TEXT: The magnetization probability distribution is calculated for a bounded one-dimensional anisotropic crystal consisting of chain molecules. In the Ising model, the free energy in such a crystal, $\Phi(H) = \Psi_0(M) - MH$, is represented as a statistical sum: $Z(H) = e^{-\beta\Phi(H)}$. $M = -\partial\Phi/\partial H$ is the magnetization (the extensive inner parameter), H - the field strength (the intensive outer parameter), $\Phi(H)$ - the free Gibbs energy, $\Psi_0(M)$ the free Helmholtz energy, $\beta = (kT)^{-1}$. The sought magnetization-probability distribution density is given in Fourier representation by

$$w(M) = \frac{1}{2\pi}\int_{-\infty}^{\infty} e^{-i\nu M}\frac{Z(H+ikT\nu)}{Z(H)}\,d\nu. \qquad (7).$$

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Statistics of magnetization...

The Hamiltonian of a one-dimensional Ising chain is given by

$$\mathcal{H} = -J\sum_{j=1}^{N-1}[S_jS_{j+1}-1] - \mu H\sum_{j=1}^{N}S_j. \tag{9}$$

where μS_j are the components of the dipole moment of the elementary dipole. For N dipoles,

$$Z(H) = \left[\operatorname{ch}\eta + \frac{x+\operatorname{sh}^2\eta}{\sqrt{\operatorname{sh}^2\eta+x^2}}\right]\Lambda_1^{N-1} + \left[\operatorname{ch}\eta - \frac{x+\operatorname{sh}^2\eta}{\sqrt{\operatorname{sh}^2\eta+x^2}}\right]\Lambda_2^{N-1}, \tag{10}$$

$$\left.\begin{array}{c}\Lambda_{1,2} = \operatorname{ch}\eta \pm \sqrt{\operatorname{sh}^2\eta + x^2}; \\ x = e^{-2\beta J};\ \eta = \beta\mu H.\end{array}\right\} \tag{11}$$

results from exact calculation. $Z'(H) = \Lambda_1^N + \Lambda_2^N$ or, approximately, $Z'(H) = \exp[\beta M_o\sqrt{H^2+H_o^2}] + \exp[-\beta M_o\sqrt{H^2+H_o^2}]$ (17) holds for a dipole chain forming a loop. By means of these formulas, the distribution density (7) is calculated with the new variable $p = \beta H + iv$.

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Statistics of magnetization...

$$w(M) = e^{\beta\Phi+\beta MH}\left[\frac{1}{M_k} I_0\left(\frac{\sqrt{M_0^2-M^2}}{M_k}\right) + \frac{M_0}{M_k\sqrt{M_0^2-M^2}} I_1\left(\frac{\sqrt{M_0^2-M^2}}{M_k}\right) + \delta(M-M_0) + \delta(M+M_0)\right]. \tag{25}$$

is found, and, with the aid of (17),

$$w(M) = \frac{e^{\beta MH}}{Z'(H)}\left[\frac{M_0}{M_k\sqrt{M_0^2-M^2}} I_0\left(\frac{\sqrt{M_0^2-M^2}}{M_k}\right) + \delta(M-M_0) + \delta(M+M_0)\right] \tag{26}$$

for a closed chain. $M_o = \mu N$, $H_o = kT\varkappa/\mu$. The probability for all dipoles to have positive (or negative) orientation is given by $\mathcal{P}_{\pm} = \frac{e^{\beta MH}}{Z(H)}$ $(M = \pm M_o)$, or, for a closed chain $\mathcal{P}_{\pm} = e^{\beta MH}/Z'(H)$. In the following, the author derives and discusses asymptotic formulas for the probability

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Statistics of magnetization...

distribution with large M_0. With $\Phi_{as}(H) = -M_0\sqrt{H^2 + (kT/M_k)^2}$ (M_k - mean magnetization of the correlation region) and $\Psi_{as}(M) = -(kT/M_k)\sqrt{M_0^2 - M^2}$, $\tilde{w}(M) = \exp[\beta\tilde{\Phi}(H) + \beta MH - \beta\tilde{\Psi}_0(M)]$ is found with

$$\left.\begin{aligned}\Psi_0(M) &= -kT\ln\left\{\frac{1}{\sqrt{2\pi}\sigma}\left[\frac{M_0}{M_k}F(M) + e^{-\frac{(M-M_0)^2}{2\sigma^2}} + e^{-\frac{(M+M_0)^2}{2\sigma^2}}\right]\right\};\\ F(M) &= \int_{-M_0}^{M_0} e^{-\frac{(M-M')^2}{2\sigma^2}} I_0\left(\frac{\sqrt{M_0^2 - M'^2}}{M_k}\right)\frac{dM'}{\sqrt{M_0^2 - M'^2}}.\end{aligned}\right\} \quad (37)$$

This function has three minima and, at large M, increases as $\frac{kT}{2\sigma^2}(M^2 \pm 2M_0M)$; $\sigma^2 = kTM_0\mu/x$. For a region which may be considered as belonging to an infinite chain

$$w(M) = C_0^{-1}e^{\beta MH}\left[\frac{H_0^2}{kT} + \sqrt{H^2 + H_0^2}\frac{\partial}{\partial M_0} - H\frac{\partial}{\partial M}\right]f(M). \quad (41)$$

$$\mathscr{P}_{\pm} = \frac{1}{2}\left[1 \pm \frac{H}{\sqrt{H^2 + H_0^2}}\right]\exp\left[\pm\beta M_0 H - \beta M_0\sqrt{H^2 + H_0^2}\right]. \quad (42)$$

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Statistics of magnetization...

is found. N denotes the number of adjacent dipoles and M their total magnetization. Multiple magnetization correlations are investigated by means of the theory of the Markov processes. Approximate formulas are derived for a finite closed chain. In the last chapter the author discusses the applicability of the results to other systems with long-range interaction. The author thanks V. L. Ginzburg for discussions. There are 7 references: 4 Soviet and 3 non-Soviet. The two references to English-language publications read as follows: G. F. Newell, E. W. Montroll. Rev. Mod. Phys., 25, 353, 1953; C. Domb. Adv. in Phys., 9, 149, 1960; B. Kaufman, L. Onsager. Phys. Rev., 76, 8, 1244, 1949.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet im. M. V. Lomonosova (Moscow State University imeni M. V. Lomonosov)

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SUBMITTED: April 10, 1961

Card 5/5

KUZNETSOV, P.I.; STRATONOVICH, R.L.; TIKHONOV, V.I. (Moscow)

Some problems involving conditional prob lity and quasi-moment functions. Teor. veroiat. i ee . 6 no.4:458-464 '61. (MIRA 14:11)

(Probabilities)

24865 S/109/61/006/007/005/020
D262/D306

6,4400

AUTHOR: Stratonovich, R.L.

TITLE: Optimal reception of a narrow band signal of unknown frequency on a background of noise

PERIODICAL: Radiotekhnika i elektronika, v. 6, no. 7, 1961, 1063 - 1075

TEXT: In the present article, optimal receiving systems are proposed. These are designed using the principle of keeping track of the most probable value of the signal frequency. For this purpose a frequency discriminator with feedback could be used. The optimum amount of feedback is determined theoretically from the equations of optimum detection. This value varies because of the varying information. Another property of the system is that detuning Δ from resonant frequencies of the discriminator circuits is not in direct dependence on the time of the a priori determined variation of frequency and on the damping of the ccts. There are, however, certain difficulties related to the start of observations. At this instant the fre-
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quency may be far from predicted and the system will initially operate in a non-optimal regime. These difficulties are omitted in the present article. It is assumed that the initial determination of frequency is achieved using e.g. the system of parallel circuits (Ref. 3: Yu.B. Chernyak, obnarusheniye signala s neizvestnoy chastotoy i proizvol'noy nachal'noy fazoy na fone belogo shuma, Radiotekhnika i elektronika, 1960, 5,3, 366). The proposed system is then connected, the frequency determined more accurately and its changes followed. The system works in a non-stationary regime. First the aposteriori probability density of frequency is determined. Initially the signal parameters are assumed constant and having the apriori distribution density

$$w_{pr}(A, \varphi, \omega) = \frac{1}{2\pi} w_{pr}(A)\, w_{pr}(\omega). \qquad (1)$$

The distorted signal $r(t) = s(t) + n(t)$ is received during time $0 < t < T$. After reception frequency ω becomes a random quantity, determined by the a posteriori distribution density $w_{ps}(\omega, T)$ which

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has to be determined. If the noise $n(t)$ is a Markov process then there is a corresponding functional of probability $W[n(t)]$. Since the signal is statistically independent of noise the joint distribution of signal parameters can be written as

$$\text{const } w_{pr}(A, \varphi, \omega)\, W[n(t)]$$

from which the aposteriori distribution of signal parameters has the form of

$$w_{ps}(A, \varphi, \omega) = \text{const } w_{pr}(A, \varphi, \omega)\, W[r(t) - A \cos(\omega t + \varphi)]. \quad (2)$$

To obtain the aposteriori distribution for frequency Eq. (1) has to be considered and (2) integrated with respect to A and φ. Several particular cases are then given. It is stated in conclusion that the described system is not ideal. This is so because

$$\frac{d}{dT}\left(\frac{1}{\alpha}\right) = \frac{d\alpha}{dT} = -\frac{\partial^3\Phi(\omega_0, T)}{\partial\omega^2\partial T} \quad (28)$$

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Optimal reception of a ...

in particular is approximate only representing the first equation of a more complicated system, but the corresponding error is the smaller, the greater the accuracy of the aposteriori evaluated frequency. [Abstractor's note: Eq. (28) is the equation of optimum filtration (detection) in Gaussian approximation]. The author acknowledges the interest taken in his work by Yu.B. Kobzarev and A.Ye. Basharinov. In the two appendices the mathematical analysis is given of the aposteriori probability with the correlated noise as given in Eq. (2) and also that with fluctuating noise. There are 2 figures and 5 references: 4 Soviet-bloc and 1 non-Soviet-bloc. The reference to the English-language publication reads as follows: P. Bello, Joint estimation of delay, Doppler and Doppler rate, IRE Trans., 1960, IT-6, 3, 330.

SUBMITTED: April 28, 1960

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6.9700

AUTHORS: Kul'man, N.K., and Stratonovich, R.L.

TITLE: Certain optimum installations for detecting a pulse signal of random duration in the presence of noise

PERIODICAL: Radiotekhnika i elektronika, v. 6, no. 9, 1961, 1442 - 1451

TEXT: It is assumed that the useful signal is a Markov process, i.e. the time during which the signal remains in each of its possible states has an exponential a priori law of distribution. When considering a stationary problem, the optimum filter may also be designed from the linear Kolmogorov-Wiener theory, but it will be worse than the non-linear system, designed according to the Markov theory, since according to the former an optimum system has to be found in the class of linear ones, while the real optimum system is non linear. The theoretical expansion of those systems is mathematically rather difficult, so that the authors restrict their analysis and comparison to an assymetrical signal and a small noise

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Certain optimum installations ...

level. They prove that in case of filtering-out of a strongly assymmetrical rectangular and random signal from the background of white noise, the optimum non-linear and linear filters are characterized by false signal detection and non-detection. Filtering of a generalized telegraphic signal is considered composed of a train of rectangular pulses which may have values +a and -a. The pulses have a given number α and β of transitions from +a state into $-a(\alpha)$ and from -a into $+a(\beta)$. The noise is assumed to be white noise with a spectral density N(nn_{τ} = $N\delta(\tau)$). The a priori probabilities w^+ and w^- are in states -a and -a and satisfy therefore

$$\dot{w}^+ = - \alpha w^+ + \beta w^-, \quad \dot{w}^- = \alpha w^+ - \beta w^-.$$

The signal represents thus a Markov process. The following equation for optimum filtering, in dimensionless parameters is then obtained:

$$\frac{dz}{dt_0} = - (\mu - \nu) - z + \frac{1}{Q} (1 - z^2) r_1(\tau_0) \quad (1)$$

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Certain optimum installations ...

In it $z(t_o) = w_{ps}^{+}(t_o) - w_{ps}^{-}(t_o)$, where w_{ps}^{+} - the a posteriori probability of the signal being in state +a, w_{ps}^{-} - a posteriori probability that the signal is in state - a$(-1 < z(t_o) < +1)$; $r_1(t_o) = r(t_o)/a = s_1(t_o) + n_1(t_o)$ $[r(t_o) = s(t_o) + n(t_o)$ - signal as the input of filter]; $t_o = t(\alpha + \beta)$ - dimensionless time; $\mu = \alpha/(\alpha + \beta)$ - probability of signal being in state -a; $\nu = \beta/(\alpha + \beta)$ - probability of signal being in state +a (signal); $Q = N(\alpha + \beta)/a^2$ - the generalized noise to signal ratio. Using the above notation, for a non-linear system of filtering, the number of false signals per unit time is derived as

$$\gamma_n = \frac{\mu - \nu + \frac{1}{Q}}{\frac{K}{1+\frac{\mu-\nu}{2}Q}(Q\sqrt{\mu\nu})} e^{-\frac{Q}{2}\left[\frac{1+(\mu-\nu)}{1-(\mu-\nu)}\right]^{-\frac{1}{2}\left(1+\frac{\mu-\nu}{2}Q\right)}}, \qquad (10)$$

where k is a factor limiting the value of noise. For linear filter-

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ing

$$\gamma_l = \frac{A}{B}\sqrt{\frac{A}{\pi Q}}\left(b_1 + \frac{B}{A}\right)\exp\left\{-\frac{A}{B^2 Q}\left(b_1 + \frac{B}{A}\right)^2\right\}. \qquad (12)$$

and

$$D_l(\tau) = \frac{1}{2} + \frac{1}{2}\Phi\left[\frac{b_1}{B}\sqrt{\frac{2A}{Q}}\,e^{A\tau} + \sqrt{\frac{2}{AQ}}\,(2 - e^{A\tau})\right] \qquad (14)$$

are derived for the same quantity, where $b_1 = b/a$. A and B are given by

$$A = \sqrt{1 + \frac{8\mu\nu}{Q}}; \qquad B = \frac{8\mu\nu}{Q}\,\frac{1}{1 + \sqrt{1 + \frac{8\mu\nu}{Q}}};$$

$D(\tau)$ is the probability of non-detection of a positive pulse, I is not defined. It is shown that the theoretical evaluation of filtering errors shows good agreement with experimental results of N.K. Kul'man and P.S. Landa (Ref. 5: Radiotekhnika i elektronika, 1961, 6, 4, 506). From the obtained formulae for filtering errors the

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Certain optimum installations ...

graphs are given which show the properties of signal detection for a non-linear and a linear filtering system. There are 2 figures and 9 references: 8 Soviet-bloc and 1 non- Soviet-bloc. The reference to the English-language publication reads as follows: N. Wiener, The extrapolation, interpolation and smoothing of stationary time series, J. Wiley, N.Y., 1949.

ASSOCIATION: Fizicheskiy fakul'tet moskovskogo gosudarstvennogo universiteta im. M.V. Lomonosova (Moscow State University im. M.V. Lomonosov, Faculty of Physics)

SUBMITTED: October 26, 1960

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STRATONOVICH, R.L. (Moskva)

Optimum filtration of a telegraph signal. Avtom. i telem. 22 no.9:1163-1174 S '61. (MIRA 14:9)
(Telegraph) (Information theory)

29005

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C111/C444

16.6300 (1031,1034,1121,1344)

AUTHOR: Stratonovich, R. L.

TITLE: Markov's conditional processes in the problems of mathematical statistics and dynamic programming

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 140, no. 4, 1961, 769 - 772

TEXT: Let $T = \{t_k : k = 0,1,2,\dots\}$, $t_k - t_{k-1} = \Delta$, $t_o = 0$. At every moment $t \in T$ a checking decision $u_t \in U_t$ may be made, the choice of which depends on the immediately preceeding decision $u_{t-\Delta}$ such that $u_t \in U_t(u_o^{t-\Delta}) = U_t(u_{t-\Delta})$, where $u_b^a = \{u_\tau : a \leq \tau \leq b$, $\tau \in T$ and $u = \{u_\tau : \tau \in T\}$.

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A phase space $E_t(u_t)$ with the points ζ_t be corresponding to every checking u_t. ζ_t indicates the couple (u_t, ζ_t). With u given, $\{\zeta_t\}$ is a random process with the probability measure $P_u(d\zeta)$. With admissible u, ζ be a Markov process with the transition probabilities:

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Markov's conditional processes...

$$P_u(d\zeta_{t+\Delta}|\zeta_t) = P_{u_t^{t+\Delta}}(d\zeta_{t+\Delta}|\zeta_t) \equiv P(d\xi_{t+\Delta}|\xi_t); \qquad (1)$$

$$P_u(d\zeta_{t+\Delta}^T|\zeta_0^t) = P_{u_t^T}(d\zeta_{t+\Delta}^T|\zeta_t) \equiv P(d\xi_{t+\Delta}^T|\xi_t).$$

Searched is the decision rule

$$u_t = \delta_t(x) = \delta_t(x_0^{t-\Delta}) \in U_t(u_0^{t-\Delta}), \qquad (2)$$

which is proclaimed on account of the observed values $x_0^{t-\Delta}$, each of these values being a known function of the corresponding ξ_t:

$$x_t = f_t(\zeta_t, u_t) \qquad (3)$$

Given is the loss function $F_t(\xi_t)$ and the searched decision (2) shall be optimal, i. e.: it shall correspond to the minimal integral mean loss. The measure $P_u(d\zeta)$ and (2) generate the measure

$$P_{\delta(x)}(dx, d\zeta) = P_{\delta_0}(dx_0)\, P_{\delta(x_0)}(dx_\Delta|x_0)\, P_{\delta(x_0^\Delta)}(dx_{2\Delta}|x_0^\Delta)\dots \qquad (4)$$

$$\dots P_{\delta(x_0^t)}(dx_{t+\Delta}|x_0^t)\dots P_{\delta(x_0^{T-\Delta})}(dx_T, d\zeta|_0^{T-\Delta}).$$

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Markov's conditional processes...

where $\delta(x_t^{\,0}) = \{\delta_{t+\Delta}(x_0^{\tau}) : 0 \leq \tau \leq t$ such that the mean loss may be written down in the following form

$$R = \min_{\delta} \int P_{\delta(x)}(dx,\, d\zeta) \int_0^T d\tau\, F_{\tau}(\zeta_{\tau}, \delta_{\tau}(x_0^{\tau})), \tag{5}$$

the minimum is searched in the class of all admissible decisions.
The author introduces the function

$$\begin{aligned} S(t \mid x_0^t, \delta_0^t) &= \min_{\delta_{t+\Delta}} \int P_{\delta^{t+\Delta}}(dx_{t+\Delta} \mid x_0^t) \ldots \\ &\ldots \min_{\delta_T} P_{\delta^T}(dx_T,\, d\zeta \mid x^{T-\Delta}) \int_{t+\Delta}^{T} d\tau\, F_{\tau}(\zeta_{\tau}, \delta_{\tau}) = \\ &= \min_{\delta_{t+\Delta}^T} \int P_{\delta}(dx_{t+\Delta}^T,\, d\zeta_{t+\Delta}^T \mid x_0^t) \int_{t+\Delta}^{T} d\tau\, F_{\tau}(\zeta_{\tau}, \delta_{\tau}) \end{aligned} \tag{7}$$

and proves that the decision $u_{t+\Delta} = \delta_{t+\Delta} \in U(\delta_0^{\,t})$ which corresponds
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to the minimum of

$$S(t \mid x_0^t, \delta_0^t) = \min_{\delta_{t+\Delta}} [P_{\delta^{t+\Delta}} (d\zeta_{t+\Delta} \mid x_0^t) F_{t+\Delta}(\zeta_{t+\Delta}, \delta_{t+\Delta}) \Delta + \tag{8}$$

$$+ \int P_{\delta_0^{t+\Delta}} (dx_{t+\Delta} \mid x_0^t) S(t + \Delta \mid x_0^{t+\Delta}, \delta_0^{t+\Delta})].$$

only depends on x_o^t, δ_o^t and is the searched optimal decision (2). If one considers the Markov properties of the processes ζ, u, then (7) is simplified to

$$S(t|x_o^t, \delta_o^t) = \int_{E_t} P_{\delta_o^t}(d\zeta_t|x_o^t) S(t|\zeta_t, \delta_t), \tag{10}$$

where

$$S(t|\zeta_t, u_t) = \min_{u_{t+\Delta}^T} \int P_{u_t^T}(dx_{t+\Delta}^T, d\zeta_{t+\Delta}^T|\zeta_t) \int_{t+\Delta}^T d\tau F_\tau(\zeta_\tau, u_\tau).$$

Thus the function

$$S(t|x_o^t, u_o^t) = S(t, u_t, w_t(d\zeta_t)) \tag{11}$$

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depends on $x_o^{\ t}$, $u_o^{\ t-\Delta}$ only by the aposteriori distribution

$W_t(d\zeta_t) = P_{u_o^{\ t}}(d\zeta_t | x_o^{\ t})$.

The equation (8) gets the form

$$S(t, u_t, W_t(d\zeta_t)) = \tag{12}$$

$$= \min_{u_{t+\Delta} \in U_t(u_t)} \left[M_{ps} F_{t+\Delta}(\zeta_{t+\Delta}, u_{t+\Delta})\Delta + M_{ps} S(t+\Delta; u_{t+\Delta}, W_{t+\Delta}(d\zeta_{t+\Delta})\right].$$

M_{ps} being the symbol of the aposteriori averaging, corresponding to $W_t(d\zeta_t)$.

The behaviour of $W_t(d\zeta_t)$ being known from the theory of conditional Markov processes, this theory may be used for the investigation of (12) and for the determination of $S(t, u_t, W_t)$ and thus in order to get the optimal function $u_t = d_t(x)$.

As special cases which can be treated this way, the author mentions

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Markov's conditional processes...

the following problems of mathematical statistics and of dynamic programming:

1.) optimal filtration
2.) successive analysis with respect to Wald (Val'd)
3.) checked observation according to Kolmogorov
4.) dynamic programming according to Bellman

4

There is 1 Soviet-bloc and 2 non-Soviet-bloc references. The two references to English-language publications read as follows: D. Blackwell, M. A. Gershick, Teoriya igr i statisticheskikh resheniy, IL, 1958 (Theory of games and of statistic decisions); R. Bellman. Dynamic programming. IL, 1960

ASSOCIATION: Moskovskiy gosudarstvennyy universitet im. M. V. Lomonosova (Moscow State University im. M. V. Lomonosov)

PRESENTED: May 19, 1961, by A. N. Kolmogorov, Academician

SUBMITTED: May 12, 1961

Card 6/6

STRATONOVICH, R.L.

Transactions of the 6th Conf. on Probability Theory and Mathematical Statistics and of the Symposium on Distributions in Infinite-Dimensional Spaces held in Vil'nyus, 5-10 Sep '60. Vil'nyus Gospolitizdat Lit SSR, 1962. 493 p. 2500 copies printed

SOV/6371

Transactions of the Sixth Conference (Cont.)

AVAILABLE: Library of Congress

SUBJECT: Mathematics

IS/jj/svb
8/5/63

Card 17/17

34272
S/188/62/000/001/004/008
B125/B138

6.9200

AUTHORS: Landa, P. S., Stratonovich, R. L.

TITLE: Theory of fluctuation transitions of various systems from one steady state into another

PERIODICAL: Moscow. Universitet. Vestnik. Seriya III. Fizika, astronomiya, no. 1, 1962, 33-45

TEXT: The authors use an approximate method to calculate the probability of transition of complex quasi-conservative nonlinear oscillation systems from one state into another. a) for weakly nonlinear systems with many degrees of freedom, the processes in which approximate either to harmonic oscillations or to the sum of harmonic oscillations with widely differing frequencies; b) for strongly nonlinear systems of the type $\ddot{x} + \gamma\dot{x} + f(x) = F(t)$ with $\gamma \ll (df/dx)^{1/2}_{mean}$. In both cases a first-order differential equation with random right-hand part can be derived, which approximately describes the behavior of a quantity z, characterizing the oscillations in the system. The passage of this quantity through a

Card 1/5

31272
S/185/62/000/001/004/006
B125/B138

Theory of fluctuation transitions of ...

boundary $z = z_1$ characterizes the transition of the system from one state to another. In the equation $\dot{z} = \varphi(z,\xi)$ (1), $\xi(t)$ denotes the noise acting upon the system. The average value $\langle \varphi(z,\xi) \rangle = f(z)$ becomes zero in the points $z=z_1$ and $z=z_0$ and with $z_0 < z < z_1$ it becomes negative. If the correlation time of the noise is less than the duration of the transition process in the system, the random action at the right-hand side of (1) can be replaced by the equivalent white noise $\xi(t)$ with the average value $f(z)$ and the correlation function $K(\tau) = N(z)\delta(\tau)$ with $N(z) = \int_{-\infty}^{\infty} \left[\langle \varphi(z,\xi)\varphi_\tau(z,\xi) \rangle - f^2(z) \right] d\tau$. The Fokker-Planck equation $(\partial w/\partial t) = -(\partial/\partial z)\left[f(z)w(z,t)\right] + (1/2)(\partial^2/\partial z^2)\left[N(z)w(z,t)\right]$ (2) which in most cases cannot be solved for the distribution of the probability density for z can be solved approximately for weak noise. If $\omega(z,z',0) = \delta(z-z')$; $\omega(z_1,z',t)$ and if (2) is solved by $\omega(z,z',t)$, we obtain with $p(t,z') = \int_\omega (z,z',t)dz$ (3). $\frac{\partial p}{\partial t} = f(z)\frac{\partial p}{\partial z} + \frac{1}{2}N(z)\frac{\partial^2 p}{\partial z^2}$ the

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Theory of fluctuation transitions of ...

equation $(1/2)N(z)d^2M/dz^2 + f(z)dM/dz + 1 = 0$ (8) for the mathematical expectation of the boundary being reached by the particle which is in position z at the initial moment. Hence, with sufficiently weak noise and with infinite integration limits we get the double value of

$M(z) = \pi \left(\sqrt{K(z_0)K(z_1)}/N(z_0)\right)^{\frac{1}{2}} e^{\psi(z_0)-\psi(z_1)}$ (13) or

$$M(z) \approx \int_{z_1}^{z_1} \frac{2}{N(z')} e^{\psi(z')} dz' \int_{z}^{z_1} e^{-\psi(z')} dz'. \quad (11).$$

Then $w(z,t) = e^{-k_0 t} w_0(z)$ can be determined from (16)

$$\frac{dp_l}{dt} = -k_l p_l(t);$$
$$k_l w_l(z) = -\frac{d}{dz}\left[f(z) w_l(z)\right] - \frac{d^2}{dz^2}\left\{\frac{N(z)}{2} w_l(z)\right\}. \quad (17).$$

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B125/B138

Theory of fluctuation transitions of ...

If all motions in the system can be regarded as harmonic oscillations with slowly varying amplitude (or as a sum of harmonic oscillations with frequencies sufficiently different from each other) the equation following from the nonlinear differential equation $y^n = F(y, y', \ldots, y^{(n-1)}, t) + \xi(t)$ (23) has the solution $y = a\, e^{jpt}$, a is a function varying slowly with time. After some calculations

$$M = \frac{\sqrt{2\pi K(a_1)}}{2a_1\delta(0)} \exp\left\{2\int_0^{a_1} \frac{a\delta(a)}{N(a)}\, da\right\}. \quad (32)$$

is obtained. If the energy losses per period due to attenuation are smaller than the oscillation energy of the nonlinear system $\ddot{x} + \gamma\dot{x} + f(x) = \xi(t)$, (37) is obtained after some calculations. The transition probability is mainly determined by the height of the potential barrier which must be overcome in the transition from one state to the other. There are 10 references, 6 Soviet and 2 non-Soviet. The two others.

Card 4/5

34272

S/166/62/000/001/004/008
B125/B138

Theory of fluctuation transitions of ...

references to English-language publications read as follows: Kramer H. A. Brownian Motion in a Field of Force and the Diffusion Model of Chemical Reactions. Physica, VII. No. 4, 284 - 304, 1940; Chanrasekhar S. Stokhasticheskiye Problemy v fizike i astronomii. IL, M., 1947

ASSOCIATION: Kafedra obshchey fiziki dlya mekhaniko-matematicheskogo fakul'teta (Department of General Physics for the Division of Mechanics and Mathematics)

SUBMITTED: April 7, 1961

Card 5/5

S/181/62/004/003/008/045
B102/B104

AUTHOR: Stratonovich, R. L.

TITLE: Theory of magnetization in the two-dimensional Ising model

PERIODICAL: Fizika tverdogo tela, v. 4, no. 3, 1962, 618 - 628

TEXT: Mathematical problems of phase transitions and critical states in the Ising model are dealt with. A method is proposed of calculating the derivatives of the magnetization curve by summation over the correlation functions. This method is complicated by the fact that at temperatures below the critical the state is spatially non-ergodic. To overcome this difficulty, the whole equilibrium state is decomposed into ergodic components. At temperatures far from the critical ferromagnetic states are bi-Gaussian so that the theory of the Gaussian equilibrium fluctuations can be applied to them. Some exact thermodynamic relationships are given for the system with the Hamiltonian $\mathcal{H} = \mathcal{H}_o - \sum_x HS_x = \mathcal{H}_o - H\sum_{i,j} S_{ij}$; with $S_x = \pm 1$, $x = (i, j)$; $\mathcal{H}_o = -Jn_o + Jn_1 - J'n'_o + J'n'_1$. The relation

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S/181/62/C04/003/008/045
B102/B104

Theory of magnetization...

$$\frac{1}{\beta}\frac{\partial M}{\partial H}=\sum_{a,\,b=0}^{\infty}\varepsilon_a\varepsilon_b\left[\langle S_{00}S_{ab}\rangle-M_0^2\right]\equiv\varkappa \qquad (16)$$

interrelating the derivative of magnetization and the correlation functions for H=0 is obtained as a general result. This relation is especially suitable at low temperatures when βJ, $\beta J' \gg 1$. Higher derivatives are treated similarly:

$$\frac{1}{\beta^m}\frac{\partial^m M^{(i)}}{\partial H^m}=\sum_{a_1b_1,\ldots,a_mb_m=-\infty}^{\infty}K\left[S_{00},\,S_{a_1b_1},\,\ldots,\,S_{a_mb_m}\right]^{(i)}. \qquad (17)$$

√

The sums are finite if the state is ergodic and so that magnetization M(H) is analytical, and analytical continuation yields the whole family of ergodic states. The behavior of the magnetization curve is studied and the spatial spectral density of the magnetization fluctuations,

$$F^{(i)}(p_1,\,p_2)=\sum_{a,\,b=-\infty}^{\infty}e^{ip_1a+ip_2b}K\left[S_{00},\,S_{ab}\right]^{(i)}. \qquad (24),$$

is expanded into series for J = J':

$$F^{(i)}(p_1,\,p_2)=F^{(i)}(0,\,0)-\frac{1}{2}F_{11}(p_1^2+p_2^2)+p^4\ldots \qquad (27)$$

$$\left(F_{11}=-\frac{\partial^2F}{\partial p_1^2}(0)\right)$$

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Theory of magnetization ...

and $$F_{11}=\overline{a^2}\sum_{a,b=-\infty}^{\infty}K[S_{00}, S_{ab}], \qquad (31).$$

$$\overline{a^2}=\frac{\sum_{ab}a^2K[S_{00}, S_{ab}]}{\sum_{ab}K[S_{00}, S_{ab}]}\sim r_2^2$$

The expansion (27) is then compared to the theory of the Gaussian correlation fluctuations when F is represented by $F^{(i)}(p_1, p_2) = K/(1 + \frac{1}{2} r_2^2 p^2)$, $p^2 = p_1^2 + p_2^2$. (27) and the following relations hold only far from the critical state. The fluctuation spectrum at the critical temperature is determined using relations obtained by Kaufman and Onsager. The results show that the critical state is spatially non-ergodic and cannot be decomposed into a finite number of ergodic states. The fluctuations are not Gaussian. There are 7 references: 2 Soviet and 5 non-Soviet. The four references to the English-language publications read as follows: L. Onsager. Phys. Rev. 65, 117, 1944; B. Kaufman. Phys. Rev. 76, 1232, 1949.

Card 3/4

S/181/62/004/003/008/045
B102/B104

Theory of magnetization ...

B. Kaufman, L. Onsager. Phys. Rev. 76, 1244, 1949; C. N. Jang. Phys. Rev. 85, 808, 1952.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet im. M. V. Lomonosova (Moscow State University imeni M. V. Lomonosov)

SUBMITTED: October 3, 1961

Card 4/4

41536

S/188/62/000/005/003/008
B102/B106

AUTHOR: Stratonovich, R. L.

TITLE: Thermodynamics of nonlinear dissipative fluctuation processes

PERIODICAL: Moscow. Universitet. Vestnik. Seriya III. Fizika, astronomiya, no. 5, 1962, 16 - 29

TEXT: New relations are derived in the thermodynamics of non-equilibrium processes and are derived here from the principle of invariance with respect to time inversion. A thermodynamic process is studied, described by internal parameters $A = \{A_1, \ldots A_n\}$ which are random functions of time describing Markov's fluctuations, and external parameters $a = \{a_1, \ldots a_n\}$ which are constants. According to Markov's principle of the probability density distribution, the equation of motion

$$\dot{w}(A) = \left[V\left(a - 2kT\frac{\partial}{\partial A}, A\right) - V(a, A)\right] w(A).$$

assumes the form

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S/188/62/000/005/003/008
B102/B108

Thermodynamics of nonlinear...

$$\dot{w}(A) = \int p(A, A')w(A')dA' - \int dA''p(A'', A)w(A), \quad (2)$$

where p(a,A) is the nonequilibrium potential and p(A",A') the differential transition probability of A' into A". For the latter,

$$p(A'', A') \rightarrow \tilde{p}(A'', A') = w_a(A')p(A', A'')\frac{1}{w_a(A'')}$$

is valid according to the principle of time symmetry and $F \rightarrow w_a F^T \cdot \frac{1}{w_a}$ where F^T is a transposed operator. Hence

$$F = w_a F^T \frac{1}{w_a}$$

$$F = e^{-\beta\Psi} F^T e^{\beta\Psi}. \quad (6).$$

Under these conditions a series of relations can be derived in classical approximation, wherein the even coefficients of the equation of motion

Card 2/4

$$p(a, A_2, A_1)\, e^{-\beta\Psi(a, A_1)} = p(a, A_1, A_2)\, e^{-\beta\Psi(a, A_2)} = $$
$$= p_0(A_1, A_2) \exp\left[\beta a \frac{A_1 + A_2}{2}\right], \qquad (21)$$

$p_0(A_1, A_2) = \exp[-\beta\Psi_0(A_1, A_2)]$ is an arbitrary function. (21) leads to

$$V(a, A) = \int p_0(A'', A) \exp\left\{\beta\Psi_0(A) + \beta a \frac{A'' - A}{2}\right\} dA'', \qquad (27)$$

and finally the equation of motion given at the beginning. Special cases are calculated as examples and purely mathematical problems are discussed in an appendix.

ASSOCIATION: Kafedra obshchey fiziki (Department of General Physics)

SUBMITTED: November 28, 1961

S/024/62/000/005/009/012
E140/E135

16.4000

AUTHORS: Stratonovich, R.L., and Shmal'gauzen, V.I. (Moscow)

TITLE: Certain stationary problems of dynamic programming

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye tekhnicheskikh nauk. Energetika i avtomatika, no.5, 1962, 131-139

TEXT: The article considers certain optimal servosystems in the presence of random forces from the point of view of Bellman's dynamic programming. The problem of applying this method to a continuous system or model is considered, where the input can be considered to be an n-dimensional Markov process. The analysis is based on the penalty function as the quality criterion. The risk is defined as the mathematical expectation of the penalty over a certain time interval. In systems with fixed parameters and signal characteristics, the risk will depend only on the duration of the interval and not on the time explicitly. A general expression for the minimum risk is given in symbolic form and it is stated that its solution is difficult except for one-dimensional problems.

B

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Certain stationary problems of ... S/024/62/000/005/009/012
E140/E135

A servosystem following a random walk is analysed, then a system with delay, and finally a system following a discontinuous Markov process.
There are 4 figures.

SUBMITTED: July 26, 1961

Card 2/2

S/109/62/007/002/001/024
D256/D303

6,4400

AUTHOR: Stratonovich, R.L.

TITLE: Separation of a signal of non-constant frequency from a noise

PERIODICAL: Radiotekhnika i elektronika, v. 7, no. 2, 1962, 187 - 194

TEXT: In a previous paper (Ref. 1: Radiotekhnika i elektronika, v. 6, no. 7, 1961, 1063) a method was proposed by the author for separating narrow band signals of an unknown frequency using a frequency of a resonance circuit to search for the frequency of the useful signal. However, there were difficulties connected with the initial stage of the search when the observer has little information on the frequency of the signal. In order to overcome these difficulties it is proposed attaining filtration by employing simultaneously a number of resonance circuits at different frequencies. The optimum system comprises coupled circuits for a non-constant frequency of the unknown signal and uncoupled circuits for constant frequency.

C

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S/109/62/007/002/001/024
Separation of a signal of non-constant.. D256/D303

Parameters of individual circuits as well as those of coupled circuits are computed using the theory of optimum non-linear filtration presented by the author in an earlier paper (Ref. 3: Radiotekhnika i elektronika, v. 5, no. 11, 1960, 1751) and the theory of conditional Markov processes. The problem of optimum filtration is considered separately for constant and non-constant amplitudes, and then the derived system of equations is reduced by neglecting the second order effects. The method is suitable for signals of constant as well as non-constant parameters and for random and regular frequency changes. There are 1 figure and 4 Soviet-bloc references.

ASSOCIATION: Fizicheskiy fakul'tet Moskovskogo gosudarstvennogo universiteta im. M.V. Lomonosova (Faculty of Physics, Moscow State University im. M.V. Lomonosov)

SUBMITTED: June 21, 1961

Card 2/2

LANDA, P.S.; STRATONOVICH, R.L.

Contribution to the theory of fluctuant transitions of various systems from one steady state to another. Vest. Mosk. un. Ser.3: Fiz., astron. 17 no.1:33-45 Ja-F '62. (MIRA 15:2)

1. Kafedra obshchey fiziki dlya mekhaniko-matematicheskogo fakul'teta Moskovskogo universiteta.
(Dynamics) (Osicllations)

STRATONOVICI, R.L.

Thermodynamics of the fluctuations in the study of irreversible processes. Analele mat 17 no.1:158-172 Ja-Mr '62.

STRATONOVICH, R.L.

Optimal detection of shifts in white noise in a production process. Vest.Mosk.un.Ser.1:Mat., mekh. 17 no.2:63-71 Mr-Ap '62. (MIRA 15:6)

1. Kafedra obshchey fiziki dlya mekhaniko-matematicheskogo fakul'teta Moskovskogo universiteta.
(Mathematical statistics) (Automatic control)

STRATONOVICH, R.L.

Thermodynamics of nonlinear fluctuation and dissipation processes. Vest. Mosk. un. Ser.3: Fiz., astr. 17 no.5:16-29 S-O '62. (MIRA 15:10)

1. Kafedra obshchey fiziki Moskovskogo universiteta.
(Quantum theory) (Thermodynamics)

39346

S/103/62/023/007/004/009
D201/D308

16.8000

AUTHOR: Stratonovich, R. L. (Moscow)

TITLE: Theory of optimum control. Sufficient coordinates

PERIODICAL: Avtomatika i telemekhanika, v. 23, no. 7, 1962, 910-917

TEXT: The author gives a general method of determining sufficient coordinates which are used in the standard methods of optimum control. The choice of optimum control is made by considering the corresponding function of minimum future risks

$$f_t = M \left\{ \min_{u_\tau,\ \tau \geqslant t} \int_{\tau > t} c_\tau \, d\tau \,\middle|\, L_t \right\} . \qquad (1a)$$

X

This function satisfies a basic equation deduced by various

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S/103/62/023/007/004/009
D201/D308

Theory of optimum...

authors (Bellman et al.) in various specific cases, which is called by the author the equation of alternatives since it helps the observer-operator in choosing one of the possible alternatives. The equation of alternatives is

$$\frac{\partial f_t}{\partial t}(X_\tau) + \lim_{\Delta \to 0} \min_{u_\tau \in U_\tau(L_t)} M\left\{\frac{f_t(X_{t+\Delta}) - f_t(X_t)}{\Delta} + c_t \middle| L_t\right\} = 0, \quad (2)$$

where $M\{-- | L_t\}$ is the symbol of the a posteriori averaging. The function $f_t(X_t)$ is sought by solving Eq. (2) with simultaneous determination of optimum control $u_t = D_t(X_t)$ at any point of space. The notion of sufficient statistics or sufficient coordinates X_t, which are the arguments of the function of risks, is determined in such a way that Eq. (2) be closed and adequate

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for obtaining the risk function and optimum control. The corresponding requirements are formulated and an illustrative example solved. A short discussion of the formulation of the problem of optimum control as given in Soviet literature is given in conclusion. N. N. Krasovskiy and A. A. Fel'dbaum are mentioned for their contributions in the field. There is 1 figure.

SUBMITTED: November 16, 1961

X

42032

S/103/62/023/011/002/007
D201/D308

AUTHOR: Stratonovich, R.L. (Moscow)

TITLE: Theory of optimal control. The asymptotic method of solution of the diffusion alternative equation

PERIODICAL: Avtomatika i telemekhanika, v. 23, no. 11, 1962, 1439 - 1447

TEXT: The author continues the analysis of the method of successive approximations for the solution of a two-dimensional stationary alternative equation with small diffuse terms, considered by him earlier (Avtomatika i telemekhanika,+ v. 23, no. 7, 1962) and applied to the particular case of an optimum follow-up system of the first order with no uncorrelated interference at the input and in the feedback loop, with the input being a diffuse Markov process, and white noise applied to the output. The separating line is determined for the above follow-up systems from the zero-approximation and higher-order approximations are considered for steady state operation of the system, which results in a more general expression for the separating line as compared with one obtained by the author in his pre-

Card 1/2

S/103/62/023/011/002/007
D201/D308

Theory of optimal control. The ...

vious article. There are 2 figures.

SUBMITTED: October 16, 1961

Card 2/2

STRATONOVICH, R.L.

"Dynamic programming methods and their application to the synthesis of optimal systems."

Report submitted to the Second Intl Congress of the Intl. Federation of Automatic Control, Basel , Switzerland, 27 Aug-4 Sep 1963

ZHIL'KOV, E.A.; STRATONOVICH, R.L.

Thermodynamics of phase transitions in certain systems. Izv. vys. ucheb. zav.; fiz. no.6:15-18 '63. (MIRA 17:2)

1. Moskovskiy gosudarstvennyy universitet imeni Lomonosova.

IVANOV, V.N.; STRATONOVICH, R.L.

Lagrangian characteristics of turbulence. Izv. AN SSSR. Ser. geofiz. no.10:1531-1593 O '63. (MIRA 16:12)

APPROVED FOR RELEASE: 08/26/2000 CIA-RDP86-00513R001653510003-7"

KOLOSOV, G.Ye. (Moskva); STRATONOVICH, R.L. (Moskva)

Problem concerning the synthesis of an optimum controller solved by dynamic programming methods. Avtom. i telem. 24 no.9: 1165-1173 S '63. (MIRA 16:9)

(Automatic control)

ACCESSION NR: AP4011719 S/0055/64/000/001/0003/0012

AUTHOR: Stratonovich, R. L.

TITLE: New form of stochastic integrals and equations

SOURCE: Moscow. Universitet. Vestnik. Seriya 1. Matematika, mekhanika, no. 1, 1964, 3-12

TOPIC TAGS: stochastic integral, stochastic equation, diffusion Markov process, contravariant vector parameter, Kolmogorov equation, smooth function, integration by parts, change of variables

ABSTRACT: The author proposes a new method for defining a stochastic integral (and stochastic differential and integral equations). This method allows the integrals to be transformed according to the conventional rules valid for expressions involving smooth functions. Contravariant vector parameters of Kolmogorov's equations are introduced. "The author expresses his gratitude to E. B. Dy*nkin and the others who joined in the discussions by the author of these problems in a seminar in the Department of Probability Theory at Moscow State University." Orig. art. has: 24 formulas.

Card ~~1/2~~ Chair of General Physics, Mechanics + Mathematics Dept.

ACCESSION NR: AP4014444 S/0188/64/000/001/0043/0049

AUTHOR: Stratonovich, R. L.; Sosulin, Yu. G.

TITLE: Computation of the detection characteristics of fluctuating signals

SOURCE: Moscow. Universitet. Vestnik. Seriya 3. Fiz. astron., no. 1, 1964, 43-49

TOPIC TAGS: fluctuating radio signal, radio signal, Gaussian noise, signal-to-noise ratio, radio receiver

ABSTRACT: A study has been made of the detection of Gaussian correlated radio signals in Gaussian correlated noise. Computation of the detection characteristics of fluctuating signals is by the approximate Middleton method. Precise expressions are derived for the errors of an optimum receiver for detection of fluctuating signals. The general relations derived are used for finding expressions for the errors of a nonoptimum detection receiver. The derived formulas make it possible to compare the quality of operation of optimum and nonoptimum detection receivers. The formulas presented for errors in both types of receivers are precise and correct for the entire range of change of the signal-to-noise ratio, signal correlation time and noise correlation time. The formulas also can be used in tabulating detection characteristics by means of computers. Such an undertaking would make it possible to compare the quality of operation of both types of detector for any

APPROVED FOR RELEASE: 08/26/2000 CIA-RDP86-00513R001653510003-7"

ACCESSION NR: AP4014444

signal and noise parameters. Orig. art. has: 31 formulas.

ASSOCIATION: MOSKOVSKIY GOSUDARSTVENNY*Y UNIVERSITET, KAFEDRA OBSHCHEY FIZIKI DLYA MEKHMATA (Department of General Physics for the Mechanics of Materials, Moscow State University)

SUBMITTED: 13Apr63 DATE ACQ: 12Mar64 ENCL: 00

SUB CODE: PH NO REF SOV: 004 OTHER: 001

Card 2/2

L 29531-65 EEO-2/EWT(d)/EWT(1)/EEC-4/T/EED-2/EWP(1)/EWA(h) Pn-4/Pl-4/Peb
IJP(c)

ACCESSION NR: AP5002679 S/0280/64/000/006/0010/0022

AUTHOR: Stratonovich, R. L. (Moscow); Sosulin, Yu. G. (Moscow)

44
B

TITLE: Optimal detection of a Markov process in noise

SOURCE: AN SSSR. Izvestiya. Tekhnicheskaya kibernetika, no. 6, 1964, 10-22

TOPIC TAGS: Markov process, signal detection, radar

ABSTRACT: The problem of optimal detection of a Markov process in an additive noncorrelated noise is considered. The likelihood ratio Λ is formed and compared with a threshold H; if $\Lambda > H$, a decision u_1 is made; if $\Lambda < H$, decision u_0. Choice of the optimality criterion affects only the threshold H. The quality of detection is characterized by the first-kind error (false alarm) α_0 and the second-kind error (signal missing) β_0. In the case of Markov processes, the likelihood Λ can conveniently be regarded as a function of a-posteriori probabilities or parameters. A special nonlinear filter unit designed by nonlinear-optimal-filtration methods generates this function. The signal from this unit is applied to the next nonlinear unit which generates the likelihood ratio or its

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ACCESSION NR: AP5002679

logarithm. The final unit compares the likelihood ratio with the threshold. Auxiliary a-posteriori errors α_k and β_k are introduced to facilitate calculating the a-priori errors α_o and β_o. The general formulas developed are reduced to those describing a normal Markov process in a white noise. The latter problem can be solved by means of a conventional theory including direct calculation of the likelihood ratio; this problem illustrates the techniques applicable to more complicated cases where direct calculation of the likelihood ratio is impossible. Formulas for α_o and β_o are also derived for the case when the time of observation is considerably longer than the time of correlation of the process being detected. Orig. art. has: 2 figures and 85 formulas.

ASSOCIATION: none

SUBMITTED: 21Jan64 ENCL: 00 SUB CODE: IE, MA

NO REF SOV: 007 OTHER: 000

Card 2/2

ACCESSION NR: AP4009976 S/0109/64/009/001/0067/0077

AUTHOR: Kul'man, N. K.; Stratonovich, R. L.

TITLE: Phase automatic frequency control and optimum measurement of the parameters of a narrow-band variable-frequency signal in noise

SOURCE: Radiotekhnika i elektronika, v. 9, no. 1, 1964, 67-77

TOPIC TAGS: AFC, phase AFC, AFC scheme, variable frequency signal, variable frequency signal filtration

ABSTRACT: The synthesis of nonlinear feedback filters with smoothing units was considered by I. A. Bol'shakov, et al. ("Problems of nonlinear filtration - 1," Avtomatika i telemekhanika, 1960, 21, 3, 301); the smoothing units had complicated transfer functions $(C(t, \tau), G(t, \tau), A(t, \tau))$, determined by integral equations. In the present article, differential, not integral, equations are modeled which excludes the smoothing units. Block diagrams are suggested for the approximate

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ACCESSION NR: AP4009976

optimum filtration of a signal from the white noise; filtration errors are evaluated. Schemes for wandering-phase and wandering-frequency cases are given. Formulas are developed which show the effect of a-priori signal characteristics and noise intensity on the optimum parameters of the scheme. A variational problem is solved for the wandering-phase case; it is proven that the theory of nonlinear optimum filtration can yield results with a minimum mean-square error. It is also proven that, in general, the evaluated frequency differs from that of the phase AFC oscillator. Orig. art. has: 4 figures and 45 formulas.

ASSOCIATION: none

SUBMITTED: 12Dec62 DATE ACQ: 10Feb64 ENCL: 00

SUB CODE: CO NO REF SOV: 008 OTHER: 000

Card 2/2

L 16402-65 EWT(d) IJP(c)
ACCESSION NR: AP4047574 S/0103/64/025/010/1433/1441

AUTHOR: Dobrovidov, A. V. (Moscow); Stratonovich, R. L. (Moscow)

TITLE: Synthesizing optimal automata that operate in random media

SOURCE: Avtomatika i telemekhanika, v. 25, no. 10, 1964, 1433-1441

TOPIC TAGS: optimal automaton, random medium

ABSTRACT: Synthesizing an automaton which interacts with a random medium whose sequence of states is describable by a Markov chain is considered. An approximate method based on quantization of a-posteriori probability (replacing interval 0, 1 with a finite number of points) is used to make possible the application of the optimum algorithm (automaton with an infinite storage capacity) to the finite automaton. Unlike the linear-tactics automaton, the new automaton is synthesized with an a-priori knowledge of the random-medium parameters. Both automata are compared on the average-penalty basis. Recurrent

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L 16402-65
ACCESSION NR: AP4047574

transformation of a-posteriori probabilities are used. An example of a two-action automaton functioning in a two-state medium is used to illustrate the method of synthesis. "The authors wish to thank M. L. Tsetlin for his perusal of the article and valuable remarks." Orig. art. has: 3 figures and 50 formulas.

ASSOCIATION: none

SUBMITTED: 08Jul63 ENCL: 00

SUB CODE: DP, MA NO REF SOV: 004 OTHER: 000

Card 2/2

L 19710-65 ASD(a)-5/ESD(dp)
ACCESSION NR: AP5001758 S/0103/64/025/012/1641/1655

AUTHOR: Kolosov, G. Ye. (Moscow); Stratonovich, R. L. (Moscow)

TITLE: An approximate method for solving the problems of the synthesis of optimal controllers B

SOURCE: Avtomatika i telemekhanika, v. 25, no. 12, 1964, 1641-1655

TOPIC TAGS: optimal controller synthesis, dynamic programming, Bellman equation, approximate solution, loss function, successive approximation method, second order system

ABSTRACT: It is pointed out that the methods of dynamic programming recently used extensively in synthesizing optimum controllers make it possible accurately to define the synthesis problem and to reduce it to the solution of a nonlinear differential equation (equation of alternatives, or Bellman's equation) for the loss function. In many cases, the exact solution of this equation is impossible, therefore, its approximate solution is considered. The method of successive approximations is presented for the case in which the diffusion

L 19710-65
ACCESSION NR: AP5001758

0

terms of this equation are not small. (In the case of small diffusion terms, the method of approximate solution of Bellman's equation was presented by the author in Avtomatika and telemekhanika, v. 23, no. 11, 1962.) How an approximate solution can be obtained by using this method is shown for a control system with the transfer function

$$K(p) = \frac{1}{p^2 + \beta p + 1}$$

of the controlled process. Bellman's equation is derived for such a control system and zero and first approximations of the loss function are determined in terms of Hermite polynomials. The equation of the switching line is derived, too. It is pointed out that the method presented can be applied to the approximate solution of other control problems. Orig. art. has: 2 figures and 95 formulas.

ASSOCIATION: none

Card 2/3

L 19710-65
ACCESSION NR: AP5001758

0

SUBMITTED:	12Nov63	ENCL:	00	SUB CODE:	MA, DP
NO REF SOV:	006	OTHER:	002	ATD PRESS:	3160

Card 3/3

STRATONOVICH, R.L. (Moskva)

The value of information. Izv. AN SSSR. Tekh. kib. no.5: 3-12 S-O '65. (MIRA 18:11)

L 53021-65 EWA(k)/EWT(d)/FBD/FSS-2/EWG(r)/EWT(1)/EEC(k)-2/EEC-4/EEC(t)/T/EEC(b)-2/
EWP(k)/EWA(m)-2/EWP(1)/EWA(h) Pm-4/Pn-4/Po-4/Pp-4/Pac-4/Pf-4/Pg-4/Ph-4/Peb/Pi-4/
ACCESSION NR: AP5010682 Pl-4 SCTB/IJP(c) WG UR/0141/65/008/001/0116/0128
127
121

AUTHOR: Stratonovich, R. L.

TITLE: Quantity of information transmitted by a quantum communication channel. I.
8

SOURCE: IVUZ. Radiofizika, v. 8, no. 1, 1965, 116-128

TOPIC TAGS: information theory, 16 quantum information, quantum electronics, entropy

ABSTRACT: The author points out that once quantum principles are introduced into radio communication (laser, 25 maser, infrared and optical transmission), it becomes necessary to review the concepts of classical information theory to allow for such quantum factors as noncommutativity, uncertainty relation, and other specific quantum effects. He therefore introduces a definition of quantum information, which is the generalization of the classical Shannon definition. The definition is given in the form

$$J_{xy} = S_x + S_y - S_{xy}$$

(the notation is standard) and it is shown that the quantum information defined in

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L 53021-65

ACCESSION NR: AP5010682

this manner is non-negative, in complete analogy with the classical case. He then calculates the quantum entropy of Gaussion canonically-conjugate variables, the information communicated between two harmonic oscillators, and the information communicated between two traveling waves. The analysis is limited to the case when the input and output variables commute. In the classical limit as $\hbar \to 0$ all the formulas derived go over into the known formulas of information theory. Orig. art. has: 49 formulas.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet (Moscow State University)

SUBMITTED: 22Apr64 ENCL: 00 SUB CODE: EC

NR REF SOV: 004 OTHER: 003

Card 2/2

L 53022-65

UR/0141/65/008/001/0129/0141

ACCESSION NR: AP5010683

31
28
B

AUTHOR: Stratonovich, R. L.

TITLE: Quantity of information transmitted by a quantum communication channel. II.

SOURCE: IVUZ. Radiofizika, v. 8, no. 1, 1965, 129-141

TOPIC TAGS: information theory, quantum electronics, entropy, communication channel, quantum waveguide system, additive noise

ABSTRACT: Part I is the preceding article in the same source (Accession Nr. AP5010682), and is devoted essentially to Gaussian quantum random quantities and processes. The entropy and information are obtained for a quantum communication channel, when the communication is effected by means of an electromagnetic wave, a waveguide, a long line, etc. The equation obtained in the first part for the entropy of canonically conjugate Gaussian variables is generalized to include arbitrary (not necessarily canonically conjugate) Gaussian variables. The information communicated between two groups of Gaussian variables is then evaluated. The important case of additive noise is especially treated, and the amount of informa-

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L 53022-65

ACCESSION NR: AP5010683

3

tion carried by the wave in the case of additive noise is calculated. The obtained general formulas are modified for the concrete case when the communication can be described by means of a small parameter such as the transmission coefficient. Using this parameter, formulas are obtained in this approximation for the quantity of information and the information carrying capacity of a waveguide system with thermal noise (ideal quantum waveguide). As in the preceding paper, all the formulas obtained go over in the classical limit ($\hbar \to 0$) into the known results of information theory. "The author thanks L. B. Levitin and D. S. Lebedev for a preprint of their work." Orig. art. has: 35 formulas.

ASSOCIATION: Moskovskiy gosudarstvenny universitet (Moscow State University)

SUBMITTED: 22Apr64 ENCL: 00 SUB CODE: EC

NR REF SOV: 002 OTHER: 001

gah
Card 2/2

[illegible]

[illegible] equation with [illegible] coefficients [illegible] conditions on the discontinuity surface. Izv. vys. [illegible] (MIRA 18:9)

1. [illegible]

L 63078-65 EEC-4/EED-2/EEO-2/EWA(h)/EWT(1) Pl-4/Pn-4/Peb JM
ACCESSION NR: AP5013336 UR/0109/65/010/005/0827/0838
621.391.822:621.391.17

30
B

AUTHOR: Sosulin, Yu. G.; Stratonovich, R. L.

TITLE: Optimal detection of the diffusion process in white noise 25

SOURCE: Radiotekhnika i elektronika, v. 10, no. 5, 1965, 827-838

TOPIC TAGS: diffusion process, white noise, signal detection

ABSTRACT: A method is suggested for solving the problem of the detection of a signal regarded as an arbitrary (generally, non-Gaussian) diffusion process; white noise and continuous monitoring are assumed. Differential equations are developed which determine the time variation of a likelihood-ratio logarithm; they permit synthesizing a suitable detector. An optimal detecting receiver includes these principal units: an optimal (generally, nonlinear) filtration unit, a likelihood-ratio unit, and a conventional likelihood-ratio-threshold-comparison unit. The derived formulas are used for solving the problem of detecting a

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L 63078-65
ACCESSION NR: AP5013336

narrow-band random process in a narrow-band noise (Markov Gaussian process). The performance of the optimal detecting receiver with a fixed monitoring time T is also analyzed, for which the a-posteriori probabilities of errors of the 1st and 2nd kind are considered. The diffusion equations describing these probabilities are given in a general form applicable to a more complicated case when the noise is represented by a continuous Markov process. For the correlation time $\tau_{cor} \ll T$, the detection characteristics of a specific narrow-band process are plotted. Orig. art. has: 2 figures and 66 formulas.

ASSOCIATION: none

SUBMITTED: 13Apr64 ENCL: 00 SUB CODE: EC

NO REF SOV: 009 OTHER: 001

KC
Card 2/2

[illegible]

[illegible] function, and its [illegible] interpretation. Vest.Mosk. un. Ser. 3: Fiz., astron. no.2:44-52 Mr-Ap '[illegible]. (MIRA 18:5)

1. Kafedra [illegible] mekhaniko-matematicheskogo fakul'teta [illegible] Moskovskogo universiteta.

L 52581-65 EWT(d) Pg-4 IJP(c)

ACCESSION NR: AP5008317 S/0103/65/026/003/0443/0453

13
B

AUTHOR: Ponomarev, Yu. V. (Moscow); Stratonovich, R. L. (Moscow)

TITLE: Solving a diffusion alternative equation by means of total differential equations

SOURCE: Avtomatika i telemekhanika, v. 26, no. 3, 1965, 443-453

TOPIC TAGS: total differential equation, diffusion equation, alternative equation

16

ABSTRACT: An approximate method is suggested for solving a diffusion alternative equation having small diffusion terms by reducing it to a chain of linking total differential equations. The method is applicable to solving the problem of higher-order optimal automatic-control systems. A second-order optimal system is described by this equation:

$$f_t + yf_x + \min_u(-\delta y - x + u)f_y + \frac{N}{2}f_{yy} + c(x, y) = 0. \quad (5)$$

Card 1/2

L 52581-65

ACCESSION NR: AP5008317

By ascribing a small neighborhood to the switching line, thereby dividing the state plane into three regions, and by differentiating the above equation with respect to x and y, and by forming total time derivatives, the equation (5) is replaced by a chain (10) of linking total differential equations. The desired approximation is obtained by truncating the chain. Orig. art. has: 3 figures and 47 formulas.

ASSOCIATION: none

SUBMITTED: 17Nov63 ENCL: 00 SUB CODE: MA

NO REF SOV: 006 OTHER: 001

goh
Card 2/2

L 48954-65 EWT(d) IJP(c)

ACCESSION NR: AP5011902 UR/0103/65/026/004/0601/0614

8.
B

AUTHOR: Kolosov, G. Ye. (Moscow); Stratonovich, R. L. (Moscow)

TITLE: Optimum control of quasi-harmonic systems

SOURCE: Avtomatika i telemekhanika, v. 26, no. 4, 1965, 601-614

TOPIC TAGS: quasiharmonic system, optimum control, approximate optimum control solution 16

ABSTRACT: The authors investigated the systems whose behavior is described by the equation

$$\ddot{x} + \varepsilon\chi(x, \dot{x})\dot{x} + x = U, \tag{1}$$

where ε is a small parameter, $\chi(x,\dot{x})$ - and arbitrary function, and U - control whose modulus is limited by

$$|U| \leqslant k = \varepsilon k_0. \tag{2}$$

The problem consists of finding the minimum over $U(\tau)$ for $\tau \geq t$ of the expression

$$I[U(\tau)] = \int_t^\infty f(x(\tau), \dot{x}(\tau))\,d\tau, \tag{3}$$

L 48954-65

ACCESSION NR: AP5011902

where f(x,x) is a function of phase coordinates for which the integral (3) converges. For such quasi-harmonic control systems (in particular, close to self-oscillating systems of the Thomson type) the authors develop a method based on the asymptotic Krylov-Bogolyubov method (see N. N. Bogolyubov, Yu. A. Mitropol'skiy, Asimptoticheskiy metody v teorii nelineynykh kolebaniy, Fizmatgiz, 1963) for the approximate solution of the above-mentioned optimum control problem. The quality of operation of the optimum system found is compared with the known optimum system computed by the Pontryagin method (see L. S. Pontryagin, V. G. Boltyanskiy, R. V. Gamkrelidze, Ye. F. Mishchenko, Matematicheskaya teoriya optimal'nykh protsessov, Fizmatgiz, 1961) using the example of a lineat system. Orig. art. has: 91 formulas and 4 figures.

ASSOCIATION: None

SUBMITTED: 18Apr64 ENCL: 00 SUB CODE: IE

NO REF SOV: 004 OTHER: 001

Card 2/2

L 24172-66 EWT(d)/T/EWP(1) IJP(c) JXT(BF)

ACC NR: AP6005754 SOURCE CODE: UR/0280/65/000/005/0003/0012

36
35
B

AUTHOR: Stratonovich, R. L. (Moscow)

ORG: none

16

TITLE: The value of information

SOURCE: AN SSSR. Izvestiya. Tekhnicheskaya kibernetika, no. 5, 1965, 3-12

TOPIC TAGS: information theory, probability, information transmission

ABSTRACT: The author shows that a unified measure of the usefulness of information is possible provided two conditions are satisfied: 1) the study is conducted in the asymptotic manner, and 2) the penalty function is prescribed. Condition 1 is in full agreement with the asymptotic (thermodynamic) spirit of the Shannon information theory. Condition 2 indicates that the value of the information is, to a certain degree, a less universal concept than the quantity of information, the determination of which requires the inclusion of no function other than that of probability. The fixation of the penalty function, however, is required in another theory, the theory of optimal solutions. Therefore, the theory based on the value of information unifies the features of the Shannon information theory with the theory of optimal solutions. This hybrid theory may be termed the Shannon information theory with penalties, or the thermodynamic theory of optimal solutions. Results are presented illustrating the effectiveness

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L 24172-66

ACC NR: AP6005754

of the new theory. It is shown that methods of optimal coding and decoding should be employed in order to realize the value of information. Orig. art. has: 2 figures and 33 formulas.

SUB CODE: 09 / SUBM DATE: 21May65 / ORIG REF: 001 / OTH REF: 002

Card 2/2 FV

L 30401-66 EWT(d)/FSS-2

ACC NR: AP6008020 SOURCE CODE: UR/0406/66/002/001/0045/0057

73
B

AUTHOR: Stratonovich, R. L.

ORG: none

TITLE: The information rate in some quantum communications channels

SOURCE: Problemy peredachi informatsii, v. 2, no. 1, 1966, 45-57

TOPIC TAGS: quantum device, communication channel, data transmission, transmission line, AMPLITUDE MODULATION

ABSTRACT: The author discusses a block diagram of a quantum communications channel which incorporates both classical as well as specific quantum components. The author finds the manner in which the density matrix is transformed in the transmission line as a result of damping and summation of the efficient signal with noise. The conditional probabilities w (r/s), formed in the receiver as a result of the quantum measurement of the quantity r are obtained (where r is the coded signal received, and s is the coded signal). The amount of information transmitted is calculated for two specific types of modulation (amplitude and coherent) and the type of information receiving corresponding to these types of modulation in the case of thermal noise at a fixed power of the signal on the channel input. It is found that coherent modulation is more efficient than amplitude modulation. Orig. art. has: 49 formulas and 1 figure.

SUB CODE: 17, 20 / SUBM DATE: 30Dec64 / ORIG REF: 007 / OTH REF: 001

UDC: 621.391.6

Card 1/1

L 24121-66 EWT(d)/FSS-2

ACC NR: AP6011438 SOURCE CODE: UR/0109/66/011/004/0579/0591

AUTHOR: Stratonovich, R. L.; Sosulin, Yu. G.

ORG: none

TITLE: Optimum signal reception against a background of nonGaussian interference

SOURCE: Radiotekhnika i elektronika, v. 11, no. 4, 1966, 579-591

TOPIC TAGS: radio receiver, signal reception, signal noise ratio, signal interference, filtration, detection probability, Gaussian distribution

ABSTRACT: The theory of optimum signal reception against a background of nonGaussian interference in the presence of white Gaussian noise is explained. Equations of the optimum nonlinear filtration and equations for the probability ratio logarithm for a wide category of signals and interferences are derived. With the aid of these equations for the partial problem of the optimum detection, the optimum receiver is synthesized. In case of low intensity of white noise, an approximate evaluation of detection characteristics is developed. Orig. art. has: 3 figures and 23 formulas. [Based on author's abstract] [NT]

Card 1/2 UDC: 621.391.172

Card 2/2

SOURCE CODE: UR/0280/66/000/003/0003/0015

ACC NR: AP6028533

AUTHOR: Stratonovich, R. L.; Grishanin, B. A.

ORG: none

TITLE: Value of information when direct observation of the quantity to be estimated is impossible

SOURCE: AN SSSR. Izvestiya. Tekhnicheskaya kibernetika, no. 3, 1966, 3-15

TOPIC TAGS: information theory, game theory, mathematic analysis

ABSTRACT: On the basis of results achieved earlier (R. L. Stratonovich. Izv. AN SSSR. Tekhnicheskaya kibernetika, 1965, No. 5), the authors apply specific methods for the optimization of systems with limited information quantity to a number of instances of practical interest, heretofore not considered. A technique is proposed for the computation of the value (weight) of information when a given quantity, unerringly transmitted over a communication channel, may assume only a limited set of values. A non-thermodynamic approach is considered with the initial quantity under direct observation, and an analysis is made of the value of the indirect information derived in this approach. The thermodynamic value of this information is also considered, and a comparison is drawn between different information values for an example. Orig. art. has: 27 formulas, 1 table, and 1 figure.

SUB CODE: 09,12/ SUBM DATE: 04Jan66/ ORIG REF: 001/ OTH REF: 003

Card 1/1

ACC NR: AP6035642 SOURCE CODE: UR/0280/66/000/005/0003/0013

AUTHOR: Stratonovich, R. L. (Moscow)

ORG: none

TITLE: The value of information when observing a random process in systems containing finite automatic machines

SOURCE: AN SSSR. Izvestiya. Tekhnicheskaya kibernetika, no. 5, 1966, 3-13

TOPIC TAGS: information theory, random process, automatic control design

ABSTRACT: The theory of information value is applied to the case when the input of the receiving system, which is evaluating the process $\{x_t\}$, is subjected to a random process $\{z_t\}$. It is assumed that the system contains a fixed unit with a finite automatic machine which has r input values, k states and s output values. The capacity of the automatic machine is computed after which information value theory is used to find the theoretical limits for the level of losses, i. e., to evaluate the performance of the system as a whole. Orig. art. has: 2 figures, 1 table, 45 formulas.

SUB CODE: 09,13,12/ SUBM DATE: 12Apr66/ ORIG REF: 004

Card 1/1

ACC NR: AP7002234 (A) SOURCE CODE: UR/0280/66/000/006/0004/0012

AUTHOR: Grishanin, B. A.; Stratonovich, R. L.

ORG: none

TITLE: Value of information and sufficient statistics during observation of a random process

SOURCE: AN SSSR. Izvestiya. Tekhnicheskaya kibernetika, no. 6, 1966, 4-12

TOPIC TAGS: random process, statistic analysis, cybernetics, mathematical expectation, information, coordinate

ABSTRACT: An analysis is made of the problem of finding the most valuable information during observation of a random process on which information is limited. It is shown that the shaper of the most valuable information breaks down two stages: the shaping of a certain value which represents a set of sufficient statistics and the shaping of transmitted information as a function of sufficient statistics. The most valuable information is determined and its value is calculated for two particular cases; the only essential sufficient coordinate is

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ACC NR: AP7002234

the likelihood ratio in one case, and the posteriori mathematical expectation in the other case. In more complex cases, when there are not one, but several sufficient coordinates, determination of the regions into which the space of sufficient coordinates can be broken down, becomes difficult with a non-thermodynamic approach. But standard methods of obtaining the most valuable information relating to the thermodynamic approach, as seen in another work [Stratonovich, R. L. O tsennosti informatsii. Izv. AN SSSR, Tekhnicheskaya kibernetika, 1965, No. 5.] may be used for any number of sufficient coordinates. Orig. art. has: 20 formulas. [GC]

SUB CODE: 12/SUBM DATE: 12Apr66/ORIG REF: 005/

Card 2/2

STRATU, S.I.; KVELEROV, A.M.; GREKOV, S., red.

[Towards a communist abundance] Pentru un belshug komunist; din eksperientsa de munke a kolkhozului "Michurin", s. Trushen', Anenii-Noi. Kishineu, Editura de partid a komitetului chentral Al PK AL Moldovei, 1964. 86 p. [In Moldavian] (MIRA 18:11)

STRATULA, D.S.

The fishing industry of Kamchatka in the postwar period and several problems in developing it further. Vop. geog. Kamch. no.1:15-22 '63. (MIRA 17:10)

STRATULA, V.

RUMANIA/Cultivated Plants - Commercial. Oil-Bearing. Sugar-Bearing. M-5

Abs Jour : Ref Zhur - Biol., No 20, 1958, 91770

Author : Stratula, V.

Inst : Craiova Institute of Agronomy.

Title : A Complex of Factors (Vernalized Seeds, Mineral Fertilizers. Thinning-Out Schedules and the Amount of Mellowing) for Increasing Sugar Beet Production.

Orig Pub : Anuarul lucrar. stiint. Inst. agron. Craiova, Bucuresti, 1957, 99-193.

Abstract : Vernalization of seeds increased considerably the yield of sugar, and in a number of cases the saccharinity as well (0.5-1.0%), although on occasion it did lowered it. The thinning out during the 6-leaf stage lowered the beet crop in comparison with the earlier thinning-out during

Card 1/2

APPROVED FOR RELEASE: 08/26/2000 CIA-RDP86-00513R001653510003-7"

STRATONOVICH, V.I.

Cutaneous foreign body locator with a marker. Voen.-med. zhur. no.8:87 '62. (MIRA 16:9)

(FOREIGN BODIES)

STRATONOVICH, V.I. (Chernovtsy USSR, ul. Frunze, d.19,kv.3)

Giant hypertrophy of the gastric mucosa. Vest. rent. i rad. 37 no.2: 23-26 Mr-Ap '62. (MIRA 15:4)

(STOMACH--DISEASES)

STRATONOVICH, V.I.

Case of soft tissue tuberculoma of the anterior abdominal wall.
Vest. rent. i rad. 38 no.5:69-70 S-O'63 (MIRA 16:12)

1. Iz rentgenovskogo otdeleniya (zav. - prof. M.K.Afanas'yev)
Chernovitskogo oblastnogo onkologicheskogo dispansera.

S/081/62/000/017/102/102
B177/B186

AUTHORS: Trubitsyna, S. N., Stratu, Z. A.

TITLE: Anion polymerization of acryl nitrile at low temperatures

PERIODICAL: Referativnyy zhurnal. Khimiya, no. 17, 1962, 615, abstract 17R51 (In collection: Vopr. ispol'zovaniya mineral'n. i rastit. syr'ya Sredn. Azii. Tashkent, AN UzSSR, 1961, 123-127)

TEXT: By the polymerization of acryl nitrile (1 mole) in liquid NH_3 (- 60°, [illegible]0 min.) in the presence of sodium amide (of 0.023 mole of metallic Na) and subjected to stirring, a polymer of regular structure and molecular weight 60,000 - 70,000 was obtained with a yield of 97%. The yield of polymer decreases when the quantity of catalyst is reduced. [Abstracter's note: Complete translation.]

Card 1/1

ASKAROV, M.A.; STRATU, Z.A.

Polymerization of acrylonitrile and butyl methacrylate in the presence of metallic lithium and lithium amide in liquid ammonia. Uzb. khim. zhur. 7 no.6:66-70 '63. (MIRA 17:2)

1. Institut khimii polimerov AN UzSSR.